ARCHES NATIONAL PARK

1) Geological Evaluation to Determine the Nature of and Recharge Area for Two Springs in Arches NP.

Name of principal investigator: James Harte Email: james_harte@nps.gov

Name of institution represented: National Park Service

Purpose of study
The Utah Geological Survey (UGS) herein proposes to provide information to determine (1) the recharge area(s) and geologic controls of one spring in Courthouse Wash and one spring in Sevenmile Canyon Wash (figure1), both located near the southwestern boundary of Arches National Park, and (2) whether wells used in currently existing development are completed in the aquifer(s) supplying water to one or both of the springs.

2) Carbon and Nitrogen Cycles in Arid Lands: The Role of Biological Soil Crusts as Influenced by Soil Surface Disturbance, Climate Change and Annual Grass Invasion

Name of principal investigator: Jayne Belnap Email: jayne_belnap@usgs.gov

Name of institution represented: U.S. Geological Survey

Purpose of study
Models indicate the presence of a large carbon (C) sink at temperate latitudes in the northern hemisphere. Over thirty percent of lands both globally and in the United States consist of semi-arid or arid landscapes. Very little is known about carbon dynamics in these regions. Biological soil crusts, composed primarily of cyanobacteria, algae, lichens and mosses, can completely cover plant interspaces in undisturbed areas, and constitute 70 percent or more of the living ground cover. These soil crusts can be the dominant source of nitrogen (N) for vascular plants. They fix C at a high rate and are critical for soil stability and aggregate formation, which is important in C storage. They also absorb significant amounts of CH_4. In areas where precipitation is low and soils have low fertility, native plants often rely on intact biological soil crusts to provide increased water and nutrient flow to the broadly scattered vegetation. Thus, there are many ways in which biological soil crusts influence biogeochemical cycles and the structure and productivity of the vascular plant community.
Soil surface disturbance, invasive plants, and climate change have the potential to

dramatically alter the structure and function of biological soil crusts. The current combination of recreational use and livestock grazing is resulting in unprecedented levels of surface disturbance on many arid lands. In regions that did not have substantial amounts of surface disturbance in the Holocene, biological soil crusts disappear readily when trampled by animals or vehicles. Exotic annual grasses are invading many of these areas. Trampling and invasion results in reduced cover and changes in the species composition of biological soil crusts. This, in turn, leads to changes in processes such as decomposition, N and C fluxes, soil moisture, and nutrient availability to vascular plants. Decreases of only 1 percent of soil organic carbon in the top 10 cm of rangeland soils is equivalent to the total C emissions from all croplands nation-wide.

Changes in climate regimes, such as a shift in the summer monsoonal boundaries in the western United States, are expected to influence the composition and physiological functioning of biological soil crusts. Various crust components have different photosynthetic and respiration responses to temperature and moisture. In addition, different crusts have different methane fluxes. Therefore, changes in the timing or amount of temperature and precipitation is expected to alter soil C and N fluxes through changes in physiological response or crustal composition. This, in turn, can significantly impact vascular plant productivity.

This project will establish how alterations in species composition by surface disturbance, invasive grasses, and/or climate change may affect N and C inputs and fluxes, in different soils under different climatic regimes. Because current and expected changes in land use and climate will occur over millions of acres in western rangelands, impacts to soil crusts have the potential for dramatically affecting C cycles, N cycles, and vascular plant productivity over much of the western United States. In addition, semi-arid and arid ecosystems represent over one-third of the Earth's terrestrial surface, and most are covered by biological soil crusts. As human impacts are escalating both regionally and globally in these drier regions, the research questions posed in this proposal have significant implications for global C budgets as well.

3) GypsES West: Providing Phenologically Based Decision Support for Timing Effective Management Actions.

Name: Steve Munson Email: smunson@fs.fed.us

Name of institution represented: USDA FOREST SERVICE

Purpose of study

The models and decision support tools that will be developed from this project will facilitate the most efficacious gypsy moth control/eradication programs within the Intermountain west with the least possible impacts on non-target organisms. The project has 3 major objectives:

1. Validate improved egg hatch and larval phenology models.
2. Produce validated decision support tools for field application within western regional climates.
3. Evaluate probability of gypsy moth establishment in Utah which includes the production of probability of establishment maps. The probability of establishment maps

will produce categories of risk for all vegetative types associated with various elevations within the state of Utah.

4) A study of the distribution of Catocala benjamini and related Catocala in northeastern Arizona and southeastern Utah.

Name: John Peacock Email: lepnut@worldnet.att.net

Name of institution represented: Ohio State University

Purpose of study
The purpose of this study is to delineate the distribution of Catocala benjamini and related Catocala in northeastern Arizona and southeastern Utah, areas that are poorly, if at all, collected, and where little is known of Catocala distribution. A secondary objective is to determine the larval host plant (Quercus) associations where Catocala are collected.

5) Acoustic Monitoring in Arches National Park, 2002

Name: Skip Ambrose Email: Skip_Ambrose@nps.gov

Name of institution represented: National Park Service

Purpose of study
The primary objective of this project is to provide basic acoustic data necessary for preparation of air tour management plans for ARCH. A secondary objective is to collect acoustic data that will be useful in preparing a soundscape management plan. Specifically, these data include:

1. Natural sound levels in the primary habitats/acoustic zones in ARCH during all seasons of the year; and

2. The influence of aircraft and other man-made noise on natural sound levels.

6) Night Sky Monitoring of Parks of the Southeast Utah Group

Name: Charles Schelz Email: charlie_schelz@nps.gov

Name of institution represented: National Park Service

Purpose of study
To develop protocols and gather baseline data on night sky light levels at the four units of the Southeast Utah Group. This project will result in the development of a Night Sky Long-Term Monitoring Plan and a report that will be a template for future reports. This report will detail all protocols, fieldwork required, and test site locations, it will also provide baseline data and analysis for comparison with future monitoring.

Objective 1:
A "Night Sky Long-Term Monitoring Plan" that outlines, in detail and with examples, all protocols, database management, and analysis to be performed at each test site. It will also clearly specify night sky monitoring needs and objectives. And will provide a clear understanding of how the monitoring program will support management information needs.

This plan will identify site-specific current resource impacts. It will also attempt to address future concerns and problem areas. It will set monitorinig management standards for resource conditions and will identify and assign priorities to areas of greatest concern.

Objective 2:
An initial report of the first completed round of Night Sky monitoring based on the new system recommended in the Night Sky Long-Term Monitoring Plan (Objective 1). This will include all test sites at all four units of the Southeast Utah Group..

7) Biology and Distribution of the Butterflies of Arches National Park

Name: Clyde Gillette Email:

Name of institution represented: Utah Lepidopteran Society

Purpose of study
To create an Expanded Checklist of the Butterflies of Arches National Park which will include distribution in space and time, documented larval food plants, limited developmental histories, and some behavioral traits.

8) Impact of Introduced Grasses on Grasshopper Communities in Colorado Plateau Grasslands: Implications for Population Viability of Native Perennial Grasses

Name of principal investigator: Tim Graham Email: tim_graham@usgs.gov

Name of institution represented: USGS--Canyonlands Field Station

Purpose of study
This study will document differences in grasshopper community structure in native and cheatgrass dominated grasslands of the Colorado Plateau.

9) HISTORIC VEGETATION ANALYSIS THROUGH THE USE OF REPEAT PHOTOGRAPHY AT THE SOUTHEAST UTAH GROUP.

Name: Charles Schelz Email: charlie_schelz@nps.gov

Name of institution represented: National Park Service

Purpose of study
Little is known of the historic vegetative cover of any of the habitats of the Southeast Utah Group. The pre-grazing condition of the vegetation has been described anecdotally, but any scientific measurement or quantitative description does not exist. The use of photography to gather this information has become our last chance to determine the pre-grazing conditions. Domestic livestock grazing was introduced into the area of the Southeast Utah Group during the late 1870's. This gives us little latitude for locating historic photographs considering photography was a new invention in the 1840's. Powell's second Colorado River expedition of 1872 had a photographer (E.O Beaman) on board and many of the original glass plates survive. Many of these photos are along the Green and Colorado Rivers but some are also in the uplands above the river. The river environment is presently being studied by Belnap and Webb (personal comm. 1998) from the confluence of the Colorado and Green Rivers south through Cataract Canyon. The Belnap and Webb study, which is utilizing historic photos, is concentrating on the river environment without much analysis of the upland vegetation communities. I propose to search out all existing historic photos that are available and piece together a picture of our upland communities as they existed before the advent of domestic livestock grazing. I also propose setting up permanent long-term monitoring photo stations at the historic photo sites that have a clear and identifiable vegetative element.

This characterization of the ecosystem vegetative change and, in particular, the condition of pristine conditions of the varied habitats of the SEUG is rated as a Top Priority Critical Research Need by the 1993 Southeast Utah Group Research Plan. This work

may also facilitate the understanding of the history of the invasion of exotic species into the area and the impacts of visitor use.

OBJECTIVES: Gather baseline historic photographic data and develop a long-term photographic monitoring program on vegetation change in Arches and Canyonlands National Parks, and Natural Bridges and Hovenweep National Monuments (The Southeast Utah Group).

1) Locate all existing historic photographs and in particular pre-1880 photos of the area that encompasses the Southeast Utah Group.

2) Determine the location of each photo with vegetative analysis possibilities and establish a permanently marked and documented photo-station for past, present, and future analysis of vegetation change.

3) Analyze historic and repeat photos for species composition and cover change. Also, to look at visitor use impacts.

4) Produce a final report, and lay the foundation for subsequent reports and monitoring that will assist National Park Service managers in developing resource management plans that could protect habitats of the Southeast Utah Group. This information will help in assessing impacts of internal and external operations, and visitor impacts.